NAVAL POSTGRADUATE SCHOOL

Monterey, California

THESIS

A PRELIMINARY ECONOMIC EVALUATION OF
MARINE CORPS ACQUISITION PRACTICES: UHF SATELLITE
COMMUNICATION GROUND TERMINAL ACQUISITIONS

by

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March 1989

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Unclassified

Security Classification of this page

REPORT DOCUMENTATION PAGE

1a Report Security Classification Unclassified	1b Restrictive Markings
2a Security Classification Authority	3 Distribution Availability of Report
2b Declassification/Downgrading Schedule	Approved for public release; distribution is unlimited.
4 Performing Organization Report Number(s)	5 Monitoring Organization Report Number(s)
6a Name of Performing Organization Naval Postgraduate School; 6b Office Symbol *(If Applicable)* 54Gt	7a Name of Monitoring Organization Naval Postgraduate School
6c Address *(city, state, and ZIP code)* Monterey, CA 93943-5000	7b Address *(city, state, and ZIP code)* Monterey, CA 93943-5000
8a Name of Funding/Sponsoring Organization; 8b Office Symbol *(If Applicable)*	9 Procurement Instrument Identification Number
8c Address *(city, state, and ZIP code)* Economic	10 Source of Funding Numbers: Program Element Number / Project No / Task No / Work Unit Accession No

11 Title *(Include Security Classification)* A PRELIMINARY EVALUATION OF MARINE CORPS ACQUISITION PRACTICES: UHF SATELLITE COMMUNICATIONS GROUND TERMINAL ACQUISITIONS

12 Personal Author(s) Psillas, Christopher F.

13a Type of Report	13b Time Covered	14 Date of Report *(year, month, day)*	15 Page Count
Master's Thesis	From To	March 1989	69

16 Supplementary Notation The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

17 Cosati Codes			18 Subject Terms *(continue on reverse if necessary and identify by block number)*
Field	Group	Subgroup	Telecommunications, demand, supply, acquisitions, demand management. (KR)

19 Abstract *(continue on reverse if necessary and identify by block number)*

Economic theories and concepts are used to discuss allocating scarce fiscal resources for acquiring UHF satellite communication ground terminals. This thesis provides and overview of current acquisition practices and suggests how applied economics can explicitly aid in better decision making. Keywords; Command control and communications

20 Distribution/Availability of Abstract [X] unclassified/unlimited [ ] same as report [ ] DTIC users	21 Abstract Security Classification Unclassified
22a Name of Responsible Individual William R. Gates	22b Telephone *(Include Area code)* (408) 646-2754; 22c Office Symbol 54Gt

DD FORM 1473, 84 MAR 83 APR edition may be used until exhausted security classification of this page

All other editions are obsolete Unclassified

Approved for public release; distribution is unlimited.

A Preliminary Economic Evaluation of Marine Corps Acquisition Practices: UHF Satellite Communication Ground Terminal Acquisitions

by

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Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN
TELECOMMUNICATIONS SYSTEMS MANAGEMENT

from the

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ABSTRACT

Economic theories and concepts are used to discuss allocating scarce fiscal resources for acquiring UHF satellite communication ground terminals. The thesis provides an overview of current acquisition practices and suggests how applied economics can explicitly aid in better decision making.

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1. MAGTF Organization

Marine Corps Air-Ground Task Forces (MAGTFs) provide a rapid and flexible response for world-wide contingencies and combat operations in "every clime and place".[1] From the Arctic regions of northern Norway to the Pacific and Southwest Asian theaters, MAGTFs in the form of Marine Expeditionary Units (MEUs), Marine Expeditionary Brigades (MEBs) or Marine Expeditionary Forces (MEFs) are task organized to accomplish specifically assigned missions for which they are especially tailored. Although MAGTFs generally vary significantly in force composition, the organizational structure includes a command element, a ground combat element, an aviation combat element, and a combat service support element (logistics). (Ref. 1, p.7)

2. Communication Requirements

The MAGTF commander needs sufficient and continuous communication capability to maintain command and control of subordinate, supporting, and adjacent units and to communicate with higher headquarters and other agencies. Various communication systems provide him the capability to:

- Command assigned forces;
- Control and coordinate movement, supporting fires, and logistic support; and
- Collect and disseminate information.

These communication systems are defined as either telecommunication or physical communication systems. Telecommunication systems include those associated with electrical or electronic communications such as radio, telephone, and

[1] Words from the *Marine Corps Hymn*.

data transmissions as well as visual and sound systems. Messenger service and mail are considered physical communication means. (Ref. 1, p. 29-30)

Communication users throughout the MAGTF are responsible for identifying their information transfer needs and requirements. Communication units (e.g., detachments, platoons, companies, battalions) are attached to headquarters units throughout the MAGTF to provide technical advice and resources to plan, install, operate, and maintain telecommunication circuits and pathways in response to user needs and requirements. Clearly then, communication planning is not exclusively a function of the communication unit. Effective communication planning must occur throughout the system from user to receiver.

B. COMMUNICATION PLANNING AND ECONOMICS

1. Communication Planning Definition:

"Communications planning is the process of creating, mobilizing, and/or allocating communications resources to achieve goals within a particular social, cultural, political and economic context." (Ref. 2, p.283)

2. What Is Communication Planning?

Communication planning is concerned with the efficient transfer of information between members of a group and other groups. More specifically, communication planning focuses on those channels and facilities necessary to provide the means to accomplish this information transfer in a cost effective manner. Communication planners strive to balance the requirements for information transfer (benefits) with the limitations of available systems, costs, benefits, budgetary constraints, and other factors (costs) to reach an optimal and efficient distribution of limited communication resources; that is, to achieve a balance between costs and benefits.

Optimal and efficient distribution, however, is seen differently by many communication planners depending upon their point of view, individual definitions of costs and benefits, and expectations. For example, a MAGTF has different specific goals and objectives than the Marine Corps as a whole. Therefore, what may be considered mission essential to the MAGTF commander might be

considered necessary, but ***not as necessary,*** to higher level organization with conflicting priorities. If priorities are filled by the higher level organization, the MAGTF may experience considerable delay in fulfilling its need.

Cost-benefit analysis, cost effectiveness analysis, and similar tools are often used to defend or define their perceptions of optimality and efficiency.

3. How economics influences communication planning.

a. The role of economics in telecommunication planning.

Economics provides a tool for planners to focus on optimal and efficient use of communication resources. This tool helps to identify, analyze, and quantify alternatives such as:

- Levels of communication services availability;
- Access to these services;
- Use of communication channels and facilities; and
- Costs and benefits associated with providing these services.

b. Use of economic concepts in analysis of communication problems.

An economics based decision making model assists in providing solutions to communication problems by determining and evaluating the multiplicity of factors involved with:

- Selection between alternative means;
- Allocations of human, financial, and technological resources; and
- Design of messages/information to have certain/desired affects with particular audiences.

C. ECONOMICS, COMMUNICATION PLANNING, AND UHF SATELLITE GROUND TERMINAL EQUIPMENT EMPLOYMENT

Economics attempts to define and determine what is optimal and what is efficient. Public and private sector economists, however, find it much easier to define optimality and efficiency than to determine actual quantities which achieve these standards. Within telecommunications, this problem is compounded by the wide range of communication resources available. Within radio telecommunications alone, resource allocation is unmanageable across the radio frequency spectrum. This thesis specifically looks at telecommunication economic theory and attempts to

use it to provide a framework from which better informed decisions about UHF satellite communication ground terminal equipment acquisition and employment can be made.

II. TELECOMMUNICATION ECONOMICS THEORY

A. INTRODUCTION

Applied economics attempts to maximize the net benefits obtained from the allocation of scarce resources. This chapter briefly reviews basic economic theory and begins to explore the application of economics to telecommunication resource allocation.

B. REVIEW OF GENERAL ECONOMIC THEORY

1. Demand

a. *Definition.*

> A demand function is a list of prices and corresponding quantities that consumers are willing and able to purchase in some time period, all other things held constant. Consumers are willing and able to purchase more of an item the lower the price; that is, quantity demanded per time period varies inversely with price. [Ref. 3, p. 22]

b. *Discussion.*

Demand is directly linked to price. As prices rise, consumers become less willing or unable to purchase goods in the same quantity as before. Consumption of resources drops. This concept is easily illustrated by the gasoline shortage of the early 1970's. As gasoline prices rose and waiting lines grew longer, Americans stopped purchasing gasoline at the same quantities as before. Alternatively, as prices go down, consumption rises.

(1) Demand Function. The demand function describes the factors which affect consumption levels of one unique good or service. These factors are called determinants of demand. For a given demand function, the values assigned for each determinant are fixed. The familiar demand curve graphically represents the relationship between price and quantity demanded for this single demand function. As determinants are changed or varied, new demand functions are defined, each with a unique demand curve and unique item. Movement along a specific demand curve indicates changes in quantity demanded of that unique item

as its price changes. As prices or costs of the unique item increase, demand will decrease, and vice-versa. Movements between demand curves indicate a change in demand due to a change in the underlying determinants.

Figure 1 helps illustrate this concept. Curve D_1 shows the quantity demanded of the item represented by this curve increases as the price changes from A to B. When comparing similar but not identical items, each item is represented by an unique demand function and curve. Curves D_1, D_2, and D_3 represent similar items but not identical items (perhaps different brands of beer or candy bars). As illustrated, demand for D_3 is greater than demand for D_1 and D_2.

If two goods are *substitutes*, then changes in quantity demanded of one item causes an inverse change in quantity demanded of the other item. For example, assume facsimile systems and express mail were perfect substitutes (e.g., either service would satisfy user needs equally). As express mail costs increased, user demand for facsimile services would similarly increase (although this shift might not be proportional to the decrease in demand for express mail).

If two goods are *complements*, then changes in quantity demanded for one item creates a corresponding change in quantity demanded for the complement. For example, assume telephone calls required a follow-on letter of confirmation. As telephone call prices increased and demand for telephone calls subsequently decreased, the demand for follow-on letters would similarly decrease.

(2) Telecommunication Demand Determinants. Assume for a moment a demand function with linear relationship between variables X and Y such that: $Y = a + bX$. In this example, a and b are constants, Y is the dependant variable, X is the independent variable. That is, the value associated with Y depends upon the value of X while any value of X may be assumed. In telecommunication economics, demand determinants are classified as either dependant or independent variables. This distinction is responsible for creating points on a specific demand curve. As assigned values of X change, new values of Y are plotted. Changing the number, type or character of the independent variables in a demand function may create similar yet separate and unique demand curves

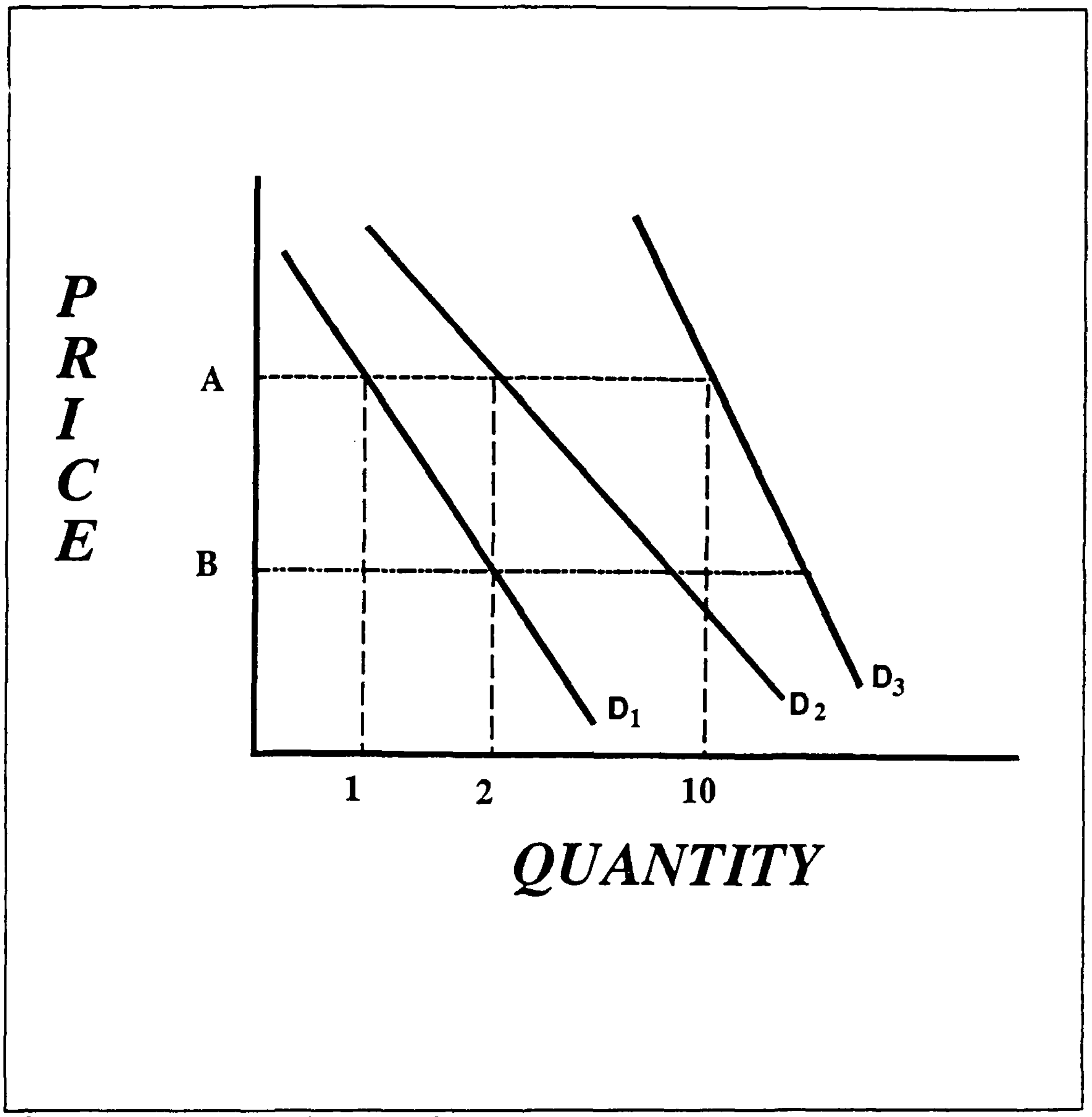


Figure 1. Demand functions

and functions.[2] Table 1 presents some determinants of demand associated with military communications. Although this table of determinants is by no means complete, it does represent many of the factors which must be evaluated within the demand function. The relationships between the dependant and independent

[2]Changes in price are generally associated with movement along a curve rather than movements between curves.

TABLE 1. MILITARY COMMUNICATION DETERMINANTS OF DEMAND

Dependent Variables

- Number of messages originating and terminating within the organization.
- The number of messages originating within the organization and terminating in another military organization (e.g., Navy originator, Marine Corps receiving).
- The number of messages originating within the organization and terminating in another non-military government agency.
- The number of messages originating in the organization and terminating in a non-government agency.

Independent Variables

- Average price of communications (message) using current transmission system.
- Average price of communications using alternative transmission system (e.g., military system -- radio, telephone, data, courier; commercial system; etc.).
- Average transmission time for message.
- Average time to complete a communication connection between transmitter and receiver.
- Defense position (posture).
- Quality of service.
- Speed of service.
- Security, reliability, flexibility of system.
- Mission requirements.
- Accessibility of system.
- User familiarity with system.

[Table adapted from Ref.4, p. 86]

variables may vary with forecasting techniques depending upon model assumptions about relative importance of each variable. Forecasting models which assume only a few determinants or which fail to define the determinants completely may overlook significant factors which influence demand.

2. Supply

a. Definition.

"Supply is a list of prices and the corresponding quantities that a group of suppliers (firms) would be willing and able to offer for sale at each price per period of time, other things held constant." [Ref. 3, p.30]

b. Discussion

Supply is closely linked to price. As the price for a good or service rises, suppliers are willing to supply greater quantities of that good or service. For example, during the 1970's, the gasoline shortage resulted in higher prices for gasoline. Domestic oil companies became willing to tap resources that were previously unprofitable at the lower price. As oil prices dropped in the 1980's, less profitable oil wells were once again capped as they became uneconomic.

Similar to the demand function, a specific set of determinants define a supply function for a unique good. Changes to the determinants create separate and unique supply functions and curves. Telecommunication determinants of supply focus on the various costs associated with providing telecommunication services to the user. In this case, the Marine Corps represents a social or overall user. Private users are individual users within a social user group. Social supply functions (e.g.,for the Marine Corps as a whole) differ significantly from the supply functions observed by the private user because the private user does not recognize all the costs. Table 2 lists a few of the different determinants of supply for social and private telecommunication users. As shown, individual or private user costs do not account for much of the cost of providing goods or services like UHF satellite communications (SATCOM). Costs borne by the society (e.g., acquisition, operator training , and depot-level maintenance) are not directly felt in the individual user's wallet (i.e., operating budget). Additionally, individual operating budgets do not

TABLE 2. MILITARY COMMUNICATION DETERMINANTS OF SUPPLY

Individual User

- Operating costs
  - -- Expendable supplies (e.g., batteries, paper goods, etc.)
- Field maintenance costs
- Operator training
  - -- On-the-job
  - -- Local schools

Social User

- Logistics costs
  - -- Expendable supplies
  - -- Field and depot level maintenance
  - -- Other life cycle costs
- Operating costs
- Operator training
  - -- On-the-job
  - -- Local schools
  - -- Military occupational specialty (MOS) schools
- Research, Development, Testing, and Evaluation (RDT&E) costs.
- Acquisition costs
- Opportunity costs
  - -- Alternate communication systems
  - -- Alternate military expenditures

recognize or feel the opportunity costs associated with their budgets. For each individual budget funded, the Marine Corps loses that money for alternative projects. The costs borne by the individual user are substantially less than the actual cost of providing UHF satcom services.

Figure 2 illustrates the relationship between social costs and private costs. As discussed, the social cost function recognizes greater costs than the private user cost function. Therefore, for a given quantity X, the private user believes the cost observed is B rather than the actual higher cost of A. Clearly, if individual users only bear a portion of the total cost, the cost of supplying a particular level of output is lower for individuals than it is for society. These functions merge only when both users recognize the same costs.

3. Optimal allocation of resources (MC=MB)

Unconstrained optimization implies that resources are expended as long as the benefit received from expending one more resource unit exceeds the cost of one more resource unit. Using additional resources is generally associated with some increase in activity level.

Constrained optimization implies that resources are not unlimited, rather that some limit (budgetary constraints, resource availability, etc.) prevents an infinite growth in expenditure or activity levels. In this case, resources are expended as long as the benefit received from expending one more resource unit exceeds the cost of one more resource unit *AND* the imposed limit on resource expenditures has not been exceeded.

The optimal allocation of resources, therefore, is that point where the expenditure of one additional resource unit just equals the benefit received. Marginal cost (MC) refers to the cost associated with providing and using one additional unit of resource. The supply curve measures the MC of expanding output.

Marginal benefit (MB) is the value that users receive from using one additional resource unit. The demand curve measures MB captured by users when they are provided one additional unit of output. Mathematically, the optimal

allocation of any resource occurs at the point where MC = MB, subject to any constraints. This point occurs where supply equals demand.

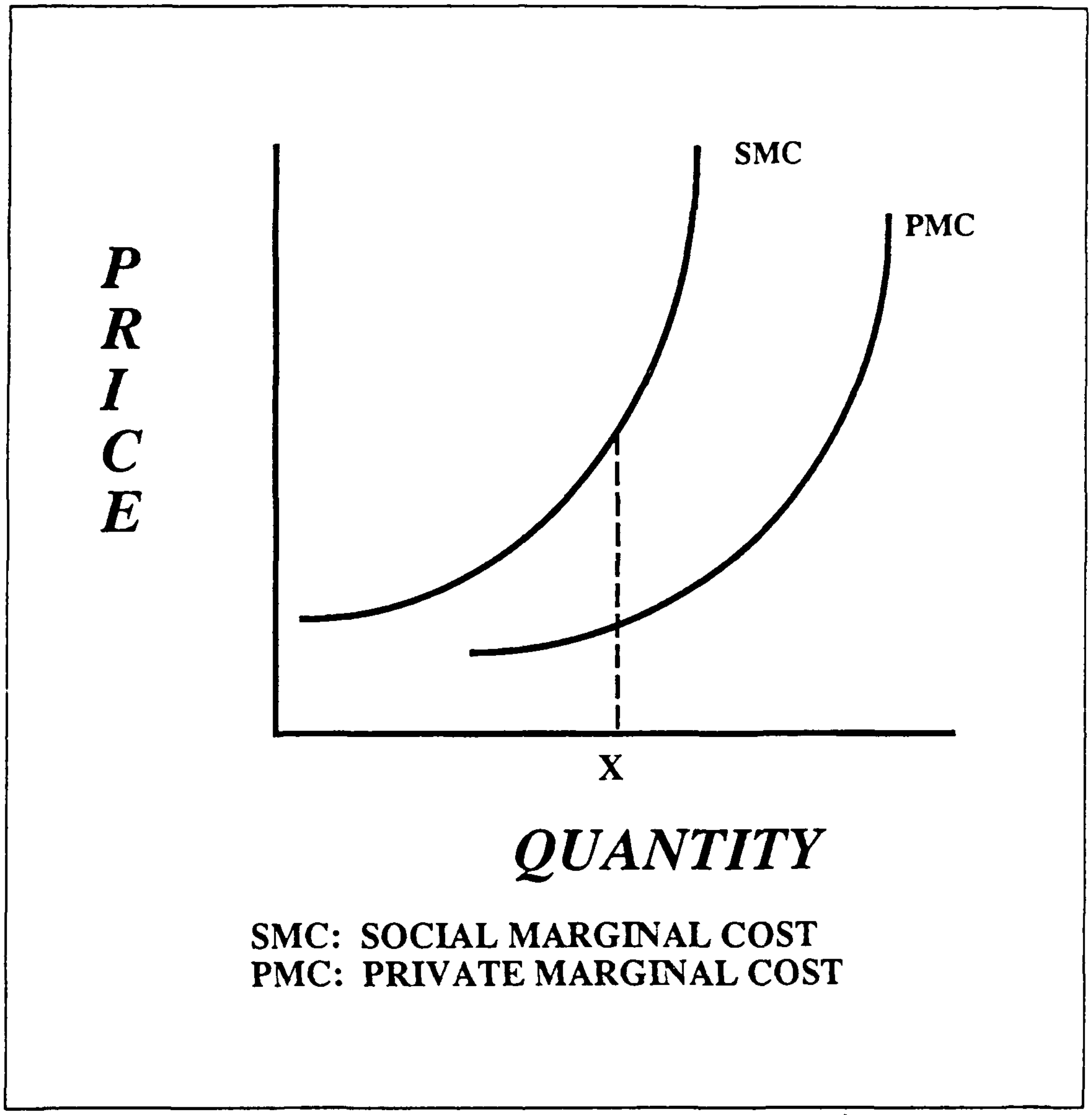
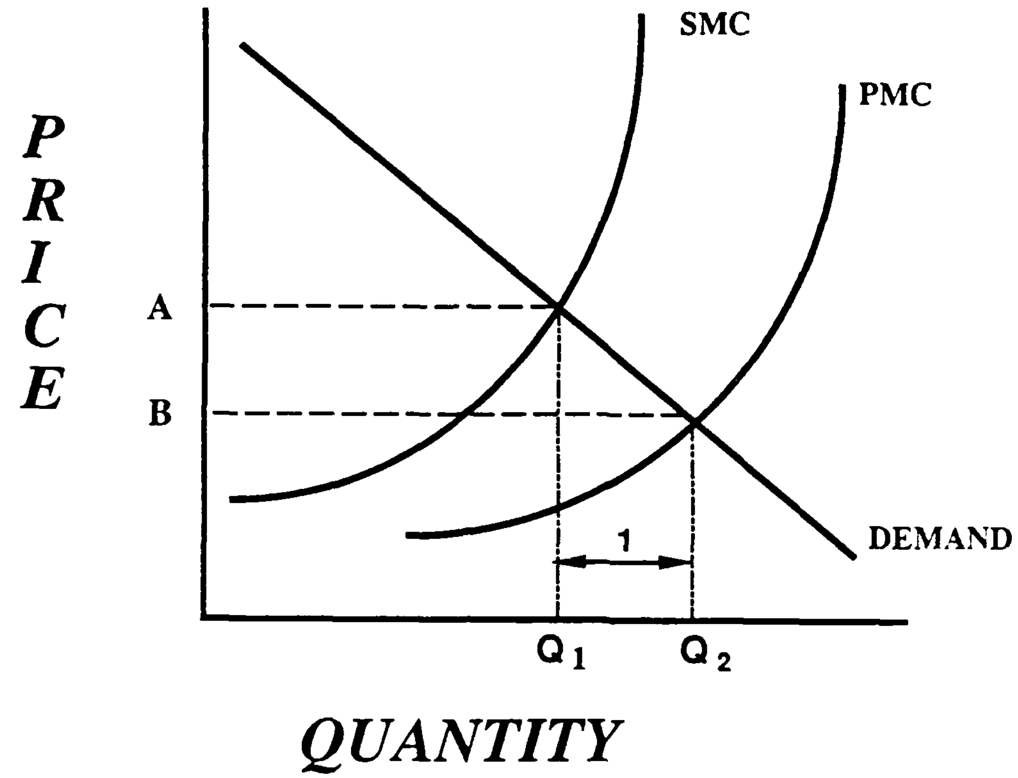


Figure 2. Social and private cost relationships

In the case of two supply functions (social and private), two cost curves are derived: a social marginal cost (SMC) and a private marginal cost (PMC). Each curve results in an "optimal" allocation of resources at the point where the marginal cost curve crosses the demand curve. As implied by Figure 3, the individual supply curve results in a greater allocation of resources than the social supply curve. The



SMC : Social Marginal Cost PMC : Private Marginal Cost

1 Excess Resource Alloation

Figure 3. Resource allocations

horizontal distance between the two observed optimal points represents an excess resource allocation. This may be illustrated further using UHF ground terminal satellite communications. Demand for these assets would be greater at the individual level than at the social level. The Marine Corps, recognizing all costs associated with the supply of these systems, is unwilling to provide the same

quantity of ground terminals that individual users would provide (request) at their recognized cost levels. Since costs are higher at the Marine Corps level, Marine Corps-wide demand for UHF satcom is lower. At the lower individual cost level, a greater quantity is demanded. Therefore, a more appropriate allocation of resources occurs using the social marginal cost in computing optimality.

C. DEMAND FOR ACCESS AND DEMAND FOR USE

Previously, a generic demand curve for a given telecommunication system or service was assumed. Within telecommunications, however, two separate yet related demand curves exist:

- Demand for Access; and
- Demand for Use (once access is achieved).

Demand for access and demand for use of a telecommunication service are interrelated in a complex fashion. Demand for access implies that some demand exists for potential users to have the capability to use a service without regard to if, when, or how they use the service. Demand for use of service implies the user has access to the service and now wants to use it. For example, having a telephone on a desk gives a potential user access to telephone services. Picking up the phone and placing a call actually uses the service. Similarly, the demand functions for UHF satcom ground terminal access and use are related but not equivalent.

Determinants of demand for access are implied through the UHF satcom ground terminal acquisition process. Needs and requirements are expressed by the user. In turn, equipment is purchased to satisfy these needs. Ownership or availability of ground terminal equipment grants access (subject to a separate demand for access issue which focuses on access to satellite channels).

Demand for use is a separate economic consideration often discussed in terms of usage sensitive billing, priority pricing mechanisms, etc. This thesis does not address demand for use topics.

D. DEMAND MANAGEMENT TECHNIQUES

Demand management techniques target excess demand for reduction. If excess demand is created by the circumstances depicted in Figure 3, additional consumer costs can be introduced to simulate the cost differences between individual and social determinants of supply. As additional individual user costs are introduced, the individual user's supply function more closely mimics the social supply function, resulting in a reduced quantity demanded. Perfect demand management achieves optimality by forcing the individual supply function to equal the demand function at the socially optimal level. Priority models and pricing models describe demand for access management techniques.

1. Priority Models

Priority demand for access management implies access to telecommunication services is limited, and that higher value users gain access first while lower value users gain access later, if at all. Additionally, equal value users gain access on a first come, first served basis. The greater waiting costs associated with not having access incurred by lower value users results in a lower quantity demanded of this service. Lower value users therefore shift to a substitute service which they can access (or forego the service altogether). For example, users wanting access to a UHF satellite communication channel are prioritized in a manner to be discussed later. Users with high priorities are assured access. Users with lower priorities may either be bumped if they already have access or may be denied access when they want it. The priority system encourages low value users to employ alternate telecommunication means with lower relative waiting costs (e.g. mail or telephone) to reduce the demand for access. Since precedence equals value, resources are allocated to users with highest precedence which results in a more optimal distribution of limited resources. Of course, this procedure has inherent weaknesses which include:

- Procedures for determining precedence may be flawed;

  What is high precedence to receiver may be of low value to the transmitter and vice-versa;

- Precedence abuse creates false "high value" users and undermines the system; and
- The first come, first served mechanism does not allow for differences in relative importance of equivalently valued messages;

All flash[3] traffic looks alike

2. Pricing Models

Pricing models create an additional costs to the user. This shifts the supply curve resulting in a lower demand for access. Three pricing schemes include:

- Peak load pricing;
- Priority pricing; and
- Quantity pricing.

Peak pricing is most useful when demand fluctuates predictably over time. Peak pricing charges higher prices during high demand periods and lower prices during low demand periods. For example, during major news events like the Olympics or political conventions, commercial broadcasters might be charged higher prices to access local transmission facilities (e.g. telephone leased lines, microwave, etc.). This higher price would discourage low value users, such as local television stations, from demanding access. High value users, such as large broadcasting networks (e.g. , ABC, NBC, CBS, ESPN, CNN) would pay the higher price associated with access. After the event, local access charges might be reduced to stimulate demand.

Priority pricing incorporates the priority management system, discussed in section D.1. of this chapter, with an explicit cost for declaring higher precedence. Priority pricing is useful when demand fluctuates randomly over a time period. True high value users are willing to pay for the higher precedence and associated access. Low value users are willing to wait for some lower demand level/period.

[3]Military message traffic is prioritzed as routine, priority, immediate or flash. Flash traffic has the highest priority.

Quantity pricing is most useful when demand chronically exceeds supply. Quantity pricing reduces demand for access by charging some premium for greater access. For example, the telephone company might charge one price for access to one phone line and a higher price for access to two phone lines. This higher price would be greater than twice the price for one phone line. As a result, fewer people would desire two phones. Quantity pricing has the opposite effect of a high volume user discount which encourages greater consumption.

Pricing schemes may be used individually or in combinations to achieve the optimal demand level. Table 3 reviews the basic relationship between demand levels and pricing schemes.

TABLE 3. DEMAND MANAGEMENT TECHNIQUES

DEMAND LEVEL	MANAGEMENT TECHNIQUE
Predictable Fluctuation	Peak Load Pricing
Random Fluctuation	Priority Pricing
Steady Or Unchanging	Quantity Pricing

The strengths and weaknesses of pricing schemes can be summarized as follows:

a. Strengths

- Pricing models are most useful when the product is economically non-storable and demand fluctuates over time;
- Pricing models cause the private user to recognize social costs as well as individual costs associated with the communications, resulting in higher observed prices and thus lower demand;
- Pricing models allow the user to make economic decisions to achieve optimal social demand levels;
  - -- User determines length of access (longer access = higher price);
  - -- User determines number of units needed (price increases as requirements increase);
  - -- User determines precedence of requirement (higher precedence = higher price); and
- Pricing models discourage consumption in peak periods and shift lower value consumption to off-peak periods;
  - -- Thus, they spread usage levels out over time and achieve more uniform utilization;
  - -- Pricing models automatically adjust to the new optimal allocation level when demand or supply change over time (Administrative policies require administrative action to adjust).

b. Weaknesses

- Pricing models are difficult to implement;
  - -- A major hurdle is "Who pays?" Ideally, the person who pays should be the person who benefits most from the communications. Should the user pay or should the command directing the user to employ a certain system pay? For example, if a user is directed to submit a certain report via a satcom net, should the sender pay or should the receiver pay?
  - -- The controlling agency must overcome user resistance to change (after all, who wants to start paying for something that used to be "free");
  - -- Supply and demand functions are difficult to quantify. As such, it is difficult to identify true optimality (the point where demand = social supply);
- Using pricing models, how do you price services?
  - -- Real money transfers may be inappropriate (or illegal);

- -- Pseudo-money or money substitutes may not provide a realistic incentive to conserve (for example, playing with fake money budgets or tokens that have no real value does not feel the same as allocating some part of a real budget towards a decision);
- -- Non-financial prices may be ineffective (witness how quickly repeated threats and other "nasty-grams" soon loose their impact); and

- With pricing models in place, how do you pay for needed resources when over budget?

E. REVIEW

The supreme goal of economics is to determine the optimal allocation of a scarce resource. To do so, an understanding of supply, demand, and optimality and demand management is necessary.

The qualitative determinants of demand and supply help quantify demand and supply functions. Since social users and private users observe different costs, at least two supply functions exist. Uncorrected, private supply considerations will always lead to an excess demand for a good or service (in this case, access to UHF satcom ground terminals). The optimal allocation of resources occurs at the point where the social supply function equals the demand function (S = D; MC = MB). Demand management techniques force private supply functions to recognize greater costs and thereby become more like the social supply function.

III. MARINE CORPS UHF SATELLITE COMMUNICATION SYSTEMS

A. INTRODUCTION

The Marine Corps has acquired and will continue to acquire specific UHF satcom ground terminals. The growth in demand for access to these terminals is a result of the perceived improvements in capabilities for command, control, and communications provided to MAGTF units. These acquisitions provide MAGTF units the ability to access specific naval communication pathways. This chapter reviews UHF satcom ground terminal characteristics and the communication pathways employed by the MAGTF.

B. NAVAL TELECOMMUNICATIONS SYSTEM OVERVIEW

1. Background

The Naval Telecommunications System (NTS) overlays certain communication pathways within the Defense Communications System (DCS) and additionally includes naval telecommunication resources that specifically support Navy and Marine operating forces. Although the NTS uses DCS pathways, they are considered separate systems. NTS provides additional internal pathways between Navy/Marine Corps users and the interface into externally employed DCS communication pathways. Postal and guard mail services, Special Intelligence (SPINTCOM), Critical Communications (CRITICOM), and electronic intelligence/electronic warfare services are not part of the NTS. Marine Corps managed and operated telecommunication systems are also not part of NTS, however, as an operational extension of NTS, Marine systems generally follow NTS operating procedures. (Ref. 5, p. II-1)

DCS provides long-haul, point-to-point, and switched network communication systems to meet the requirements of the Department of Defense, including Navy and Marine Corps forces, and other government agencies as directed. Common user sub-systems of the DCS include the Automatic Digital Network (AUTODIN), the Automatic Voice Network (AUTOVON), and the Automatic

Secure Voice Communications Network (AUTOSEVOCOM). The Defense Satellite Communications System (DSCS) provides communication paths for strategic and tactical requirements.

NTS provides common user communication services through Naval Communications Area Master Stations (NAVCAMSs) and Naval Communication Stations (NAVCOMSTAs) located around the world. They provide an interface to AUTODIN for messages leaving the NTS (e.g., messages addressed to Joint/Unified/Army/Air Force commands). The Naval Communications Processing and Routing System (NAVCOMPARS) located at the servicing NAVCAMS/NAVCOMSTA automatically routes mobile/afloat unit outgoing messages either into AUTODIN, another NAVCOMPARS or to a Local Digital Message Exchange (LDMX) which services shore based naval commands. Additionally, mobile and afloat units may access AUTOVON and AUTOSEVOCOM through a NAVCAMS or NAVCOMSTA.

2. **UHF Satellite Communication Systems**

For Marine Corps record (naval message type) and secure voice communications, Ultra High Frequency (UHF) satellite communication (satcom) common user systems provide an alternative to High Frequency (HF) and other long haul communication systems. NTS provided UHF satcom pathways may be either single use (e.g. tactical, point-to-point) or common user circuits. Common user systems used by MAGTFs include the Fleet Satellite Broadcast; Common User Digital Exchange System (CUDIXS)/Naval Modular Automated Communication Sub-system (NAVMACS); full period satellite terminations; and the Secure Voice Subsystem. (Ref. 6, p. 7)

The Fleet Satellite Broadcast (FSB) is an extension of the Fleet Broadcast System which is used to deliver message traffic to afloat/mobile units. Host ships guard[4] for MAGTF traffic during amphibious operations until the MAGTF can

[4]Communication guard implies that a host ship or unit provides message traffic receipt, transmission and page-copy routing for an embarked or supported unit.

establish communications ashore. Similarly during joint operations, a communication guard is established with a host unit until MAGTF communication systems are installed and operational. Once ashore, the MAGTF may continue to receive the broadcast or may establish other lines of communications. Message traffic addressed to an element of the MAGTF is entered by the originator into the DCS or NTS where it is routed to a Naval Communications Processing and Routing System (NAVCOMPARS) which guards for the host ship/MAGTF. At a NAVCOMPARS, the message is automatically entered onto the appropriate Fleet Broadcast (which may include FSB). Since the FSB is a one-way, send-only communication link, message traffic is receipted for, serviced, or acknowledged using separate communication systems. (Ref. 7, pp. 67-69)

CUDIXS/NAVMACS provide a UHF satellite communication link between the shore based communication system and mobile units. CUDIXS is the shore based, fixed plant receiving element of the network. The CUDIXS can receive and acknowledge traffic from up to 50 primary subscribers. The CUDIXS can transmit traffic to an additional ten subscribers designated as "special subscribers". The CUDIXS is tied automatically to the NAVCOMPARS which in turn is linked to AUTODIN and the NTS. NAVMACS is the mobile (transmission) side of the network. (Ref. 7, pp. 69-70)

Full period satellite terminations are dedicated, multichannel or single channel, full-duplex communication links between a MAGTF and a Naval Communications Station (NAVCOMSTA) or a Naval Communications Area Master Station (NAVCAMS). The NAVCOMPARS at the NAVCOMSTA or NAVCAMS can automatically forward traffic addressed to the MAGTF or introduce traffic received from the MAGTF into the NTS/DCS.

The Satellite Secure Voice Network provides to mobile units an interface into the Defense Automatic Secure Voice Communications Network. Units with NAVMACS capability may temporarily suspend message traffic operations and establish a secure voice link. Alternatively, a separate or additional secure voice circuits may be established using additional equipment.

C. GROUND TERMINAL EQUIPMENT CHARACTERISTICS

1. CUDIXS/NAVMACS (AN/TSC-96(V)).

Designed for rapid deployment and operations in severe environments, the AN/TSC-96(V) Satellite Communication Center provides access to the Fleet Broadcast, FLTSATCOM Secure Voice Network, and FLTSATCOM Common User Digital Information Exchange System (CUDIXS) via NAVMACS. The AN/TSC-96 is compatible in varying configurations with the Navy AN/WSC-3 radio and the AN/PSC-3 radio. Specifically, the system provides:

- One secure, digitized voice communication circuit;
- Secure, half-duplex teletype for a NAVMACS-CUDIXS link; and
- Capability to copy 4 of 15 multiplexed FSB channels or provide an additional secure voice channel.

AN/TSC-96(V) components are housed in a portable shelters. These shelters may be truck or trailer mounted, air lifted, or embarked aboard amphibious shipping. Portable generators supply the necessary power requirements. (Ref. 8, p. D-29)

2. Single Channel UHF Satcom Terminals.

a. AN/PSC-3.

The AN/PSC-3 Manpack Satellite Communication Terminal is a lightweight, compact, battery operated, and single channel communication terminal designed for one person installation and operation. It is intended to provide single channel UHF line of sight (LOS) and satellite communication terminations within the Marine Expeditionary Force/Brigade/Unit. AN/WSC-3 transceivers are being modified to allow satellite communications with the AN/PSC-3, which allows communications to and from AN/TSC-96 and AN/WSC-3 radios. As its name indicates, the AN/PSC-3 is transported by harnessing the radio to the operator's back. The AN/PSC-3 is similar in size and weight to the common AN/PRC-77 VHF radio. As such, it is ideally suited to rapid deployment and quick reaction communication requirements. Capabilities of the AN/PSC-3 include secure half-duplex voice or digital communications. Digital communications are provided through the AN/PSC-2 data communication terminal. (Ref. 8, p. 5-40)

b. *AN/VSC-7.*

The AN/VSC-7 is the vehicular version of the AN/PSC-3. It functions as a net control station for up to 15 PSC-3s.

3. Upgrades And Projected Systems

a. *AN/TSC-96 Product Improvement Program (PIP).*

The PIP should be completed in the 1991 time frame and should:

- Repackage the components into a one-shelter configuration;
- Replace outdated teletypewriter/printer technology with the four AN/UGC-74's;
- Upgrade communication security (COMSEC) equipment to retain interoperability with USN equipment and provide the capability to communicate with the AN/PSC-3; and
- Include the TD-1271B Demand Assigned Multiple Access (DAMA) modem to provide more efficient use of the limited UHF spectrum and retain interoperability with USN assets. (Ref. 8, p.5-40)

b. *Advanced Manpacked UHF Terminal.*

These upgrades are anticipated to begin in the 1992 time frame and continue through 2001. These improvements include:

- Replacing the analog modulation scheme with a digitized voice capability; and
- Replacement of all VHF and UHF single channel radios with an integrated VHF/UHF single channel radio system. (Ref. 8, pp. 5-77, 5-114,)

D. CLOSING

To provide an insight on why the Marine Corps acquires UHF satcom ground terminals, this chapter discussed briefly the UHF satcom pathways provided through the Naval Telecommunications System. Additionally, it reviewed UHF satcom ground terminal characteristics.

This thesis generally ignores the greater issue of demand for access to these pathways and focuses simply on demand for access as represented by ownership of or availability of these terminals.

IV. MARINE CORPS ACQUISITION MANAGEMENT

A. INTRODUCTION

This chapter discusses how needs of the Marine Corps are identified, developed, and controlled by looking at the following topics:

- Prioritization and allocation of military satellite communication (MILSATCOM) resources;
- The Marine Corps acquisition system; and
- The Department of Defense planning systems.

Figure 4 illustrates the bottom up view from the Marine Corps private user level up through the DOD social user level. From this viewpoint, private users generate user requirements in the form of requests. Social factors are theoretically filtered into the request as the request moves up the chain of command. Additionally, social users may generate separate requirements in response to a threat or vulnerability not observed by the private user. Some requirements are "weeded out" as unnecessary and discarded as they move up the chain. After the requirements reach the top of the chain of command, they begin to influence the acquisition process. The acquisition process reexamines these requirements through milestone documentation.

B. PRIORITIZATION AND ALLOCATION OF MILSATCOM RESOURCES

1. Background.

"The use of MILSATCOM systems is based on the validated operational need and on current operational considerations indicating that a MILSATCOM system, rather than an alternative transmission medium, should be used to satisfy the requirement." [Ref. 9, p.25]

2. General Considerations.

Military satellite communication (MILSATCOM) resources are prioritized and allocated for Marine consumption. Marine access to UHF satcom pathways is

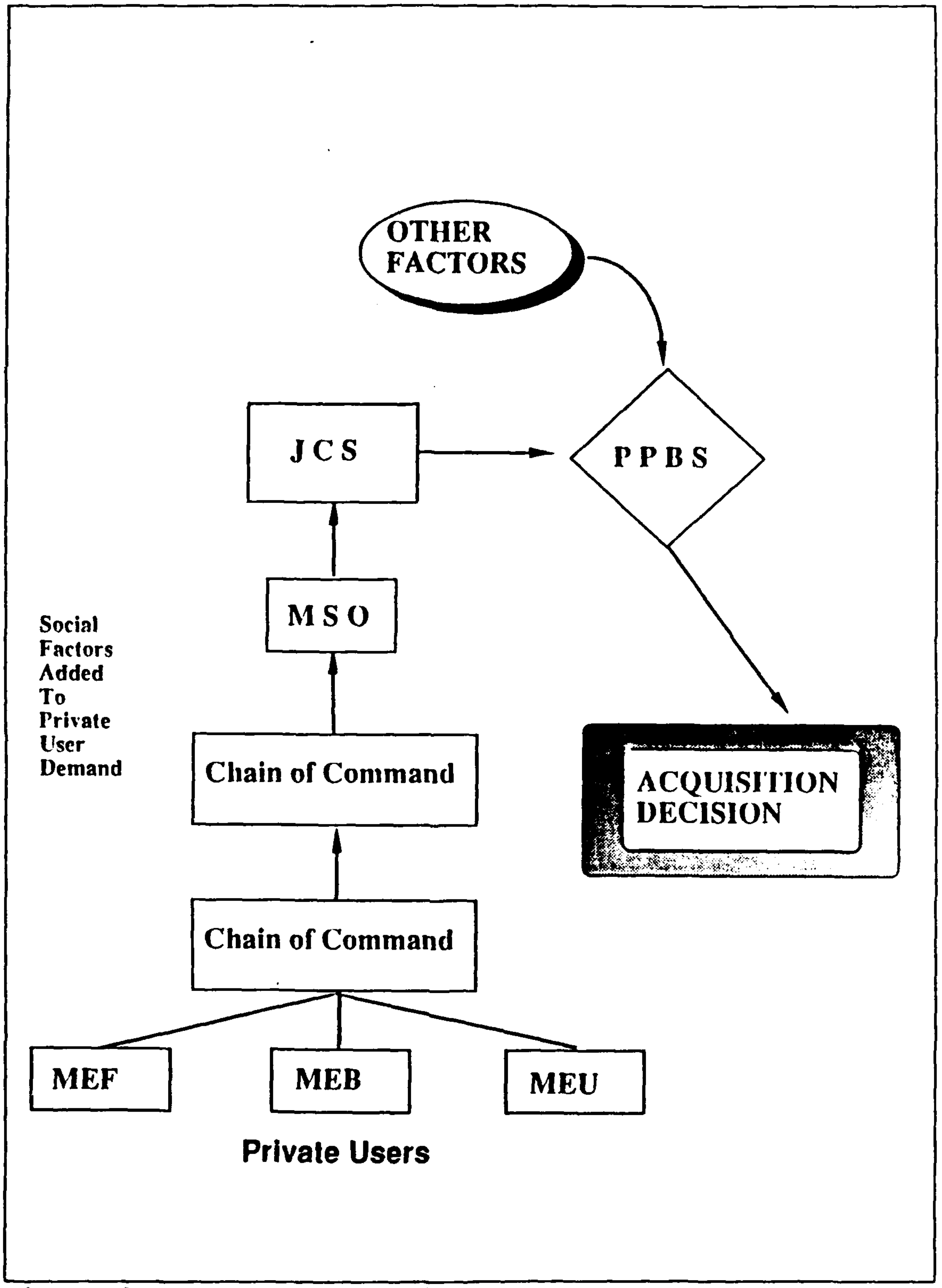


Figure 4. Sequential weeding process

controlled by the Navy based on a predetermined, validated need; the need's relative ranking among all needs serviced by the system (prioritization); and pathway availability (current operational situations).

Marines (and other users) prioritize their needs based on:

- National security importance of the information to be transmitted;
- Time sensitivity of information;
- Availability and suitability of alternate means of communications;
- Impact on other users;

  The effect of requirement satisfaction on other users; and
- Technical and operational employment considerations;

  Including satellite loading and survivability. [Ref. 9, p. 26]

A quantitative decision process is used to determine the priority assigned to individual requirements. Each category above (security importance, time sensitivity, impact, etc.) is defined by a matrix. The matrix charts level of conflict versus levels of satisfaction. Table 4 provides a matrix example.

3. User Requirements Data Base (URDB).

The URDB contains the list of MILSATCOM validated requirements and their prioritization. Not all validated requirements, however, may be currently supportable (this situation represents an excess demand for access). Validated requirements are regularly reviewed for retention as mission needs change.

Initial military user needs are submitted using the MILSATCOM URDB Requirement Request Form. Completed forms are forwarded through the chain of command (either administrative or operational chains) to the Military Satellite Communications System Office (MSO). The MSO evaluates the request and forwards the request with any recommendations to the Joint Chiefs of Staff (JCS) for validation. Once validated, the need becomes a support requirement and is entered into the URDB.

4. MILSATCOM URDB Requirement Request Form

The URDB MILSATCOM Requirement Request Form (DCA form 772) provides justification for communication service requirements to be provided by a new military satellite communication system, network, satellite constellation, or a

change to a previous system. The form may also be used to recommend the deletion of an existing requirement. Appendix A contains a sample form.

TABLE 4. TIME SENSITIVITY MATRIX

	LEVELS OF CONFLICT					
TIME SENSITIVITY	1	2	3	4	5	6
Routine	1	1	0	0	0	0
Priority	2	1	1	1	0	0
Immediate	3	2	2	2	3	1
Flash	4	5	5	5	5	6
Flash Override	5	6	7	7	7	8

[Ref. 9, p.32]

The economic model assumes the request originates at an operating unit level (private user). The operating unit generally considers only those qualitative determinants of supply associated with the private user.

As the request moves through the chain of command, the economic model suggests that higher levels in the chain begin associating more of the "big

picture" costs and benefits with the request (thereby refining the demand function and social supply function definitions).

Finally, the economic model closes the loop at the point where the URDB filters into Planning, Programing, and Budgeting System (PPBS) decisions. At this point, the demand function and the social supply function are equated in some fashion, and funds are allocated to provide the system or service requested. This funding ideally relates to the optimal level determined by the intersection of demand and supply functions (subject to any funding constraints).

C. MARINE CORPS ACQUISITION SYSTEM

1. Background.

The Defense Acquisition System functions concurrently with and in support of the Planning, Programming, and Budgeting System. The Defense Acquisition System provides the method within DOD for implementing systems acquisition policy as directed by the President's Office of Management and Budget (OMB Circular A-109). Specific policies, practices and procedures which govern DOD acquisitions include:

- Definition of the systems acquisition cycle;
- Determining and prioritizing resource requirements;
- Systems acquisition process controls and direction;
- Contracting; and
- Reporting to Congress. [Ref. 10, pp. 1,2]

2. Marine Corps Acquisitions

Most acquisition programs benefiting the Marine Corps are joint programs with other services or Federal agencies. For Marine unique programs or programs which do not otherwise satisfy Marine specific requirements, the Marine Corps Acquisition System is used. The Marine Corps Acquisition System closely parallels guidelines and policies of the Defense Acquisition System. Assigned Marine Corps acquisition responsibilities include:

- Developing new doctrine, tactics, and equipment employed by amphibious landing forces;
- Identifying equipment, weapons, or weapons systems requirements; and

- Developing, testing, and evaluating new systems;
  - -- To ensure operational effectiveness;
  - -- To ensure new systems meet long range and immediate objectives;
  - -- To ensure new systems can be acquired and supported using available resources. [Ref. 11, p. 1]

The Marine Corps Acquisition System has program decision authority for Acquisition Categories IIC and III (ACAT IIC and ACAT III). These categories are established for programs having dollar thresholds (as of FY-80) less than $100 million for research, development, testing, and evaluation and $500 million for procurement, operations, and maintenance [Ref. 11, p.5]. Additionally, Marine Corps acquisition programs assigned ACAT IIC or ACAT III do not meet the criteria for special Secretary of Defense or Secretary of the Navy interest.

For joint acquisition programs in which the Marine Corps is the lead service (Acquisition categories I, IIS), the policies and guidelines of the Marine Corps Acquisition System are modified as required to meet DOD and other service requirements.

3. System Acquisition Cycle.

The system acquisition cycle defines documentation requirements, establishes milestones and phases, and requires key decisions for each program. The documentation provides a review of actions taken, decisions made, a validation of current needs, a record of approval to enter follow-on phases and other supporting rationale. Milestones mark the end points of each phase. Actions within each phase are tailored to "minimize acquisition time and life-cycle costs, consistent with the urgency of need and degree of technical risk involved, and progress as demonstrated by validated test results." [Ref. 10, p. 3] Key decisions provide approval to enter the next phase. Disapproval at any key decision point may terminate the program. Figure 5 briefly outlines the relationship between phases, milestones, and decision points.

MILESTONE	DECISION	PHASE
		Program Initiation and Mission Need Analysis
0	Program Initiation and Mission Need Decision	
		Concept Exploration and Definition
1	Concept Demonstration and Validation Decision	
		Concept Demonstration and Validation
2	Full-Scale Development Decision	
		Full Scale Development and Low-Rate Initial Production (as authorized)
3	Full Rate Production Decision	
		Full Rate Production, Deployment, or Construction
4	Logistics Readiness And Support Review	
		Operational Support
5	Major Upgrade or System Replacement Decision	
		Program Initiation/Mission Need Analysis for Upgrades or Replacements

[Reference 12 germane]

Figure 5. Acquisition milestones, decisions, and phases

D. DEPARTMENT OF DEFENSE PLANNING SYSTEMS

Three legs comprise the Department of Defense planning system:

- Joint Operations Planning System;
- Joint Strategic Planning System; and
- Planning, Programing, and Budgeting System.

Together, they provide an integrated framework for formulating national security policy, strategy, plans, and acquisition decisions. The Joint Operations Planning System (JOPS) will not be discussed in detail, however, JOPS provides for written operational plans in complete format (OPLAN) and operational plans in concept format (CONPLAN) in response to the Joint Strategic Planning System threat identification. The Joint Strategic Planning System and the Planning, Programming and Budgeting System directly influence the acquisition of UHF satcom ground terminals, as well as all other acquisitions.

1. Joint Strategic Planning System (JSPS)

The primary objective of JSPS is to identify and evaluate military and related threats to national security. These threats later lead to identification of needs and requirements for combating the threat. The needs and requirements essentially qualitatively describe a demand function.

JSPS produces several planning documents which include the Joint Strategic Planning Document (JSPD), the Joint Strategic Capabilities Plan (JSCP), and the Joint Program Assessment Memorandum (JPAM).

The Joint Strategic Planning Document provides JCS advice to the President, National Security Council, and the Secretary of Defense on what military strategy and force structure is required to attain U.S. national security objectives. Additionally, it provides planning guidance to unified and specified commanders and each military service. The JSPD does not consider fiscal restraints; it lists all options and alternatives to be considered. The Planning, Programming, and Budgeting System is initiated by the JSPD.

The Joint Program Assessment Memorandum is prepared for the Secretary of Defense by the JCS. The JPAM contains their impartial risk assessment of DOD's ability to execute approved military strategy.

2. Planning, Programming, and Budgeting System (PPBS)

The primary objective of PPBS is to allocate scarce fiscal resources for the acquisition of those resources "necessary to meet the threat and to execute the strategy identified by the JSPS." [Ref. 13, p. 52]

In economic terms, PPBS attempts to qualitatively describe a demand function based on needs and requirements; as well as to describe a social supply function based on observable costs. The hoped for end result is an optimal allocation of scarce resources. PPBS does this by:

- Developing an acquisition strategy with regards to the threat;
- Developing force requirements to support the strategy; and
- Developing programs to provide an orderly basis for the achievement of force objectives, weapons systems objectives and their logistics support. [Ref. 13, p.51]

The JCS, unified and specified commanders, and military services advise the Secretary of Defense through the PPBS concerning issues related to their abilities to satisfy force requirements within fiscal constraints. The PPBS results in budget inputs for the President's budget submission and provides the rationale for the Five Year Defense Plan (FYDP).

V. MARINE CORPS ACQUISITION AND ECONOMICS

A. INTRODUCTION

So far this thesis has described what UHF satcom ground terminals and associated systems are available; what economic theory says about supply, demand, and optimal quantities (how much do we buy?); and, what policies and practices are currently used to make this economic decision.

This chapter examines how economics is applied in the established decision making process.

B. HOW ECONOMICS VIEWS DEMAND, SUPPLY, AND OPTIMAL QUANTITIES

"Economic theory assumes an omniscient and omnipotent overseer who can make perfectly informed decisions." [Ref. 14]

As discussed in Chapter II, economic theory says that for any UHF satcom telecommunication system, private users such as a MAGTF could be associated with a private supply function and a private demand function reflecting recognized costs and benefits received. Additionally, the Marine Corps as a society would similarly develop a social demand and supply function. Since the private users reap the majority of benefits associated with access to terminals and satellite communication systems, the social demand function would closely resemble the aggregate of all private demand functions (e.g. the sum of multiple MAGTF's demand functions). The social supply function, however, would be significantly different. All private user recognized costs plus all private user non-recognized costs would factor into the determinants of a social supply function.

Economics assumes that decision makers can identify and quantify all relevant costs and benefits. In this setting, the Marine Corps can easily determine the optimal quantity of AN/PSC-3s to purchase and provide to MAGTFs. As discussed earlier, that point would be where the Social Marginal Costs just equals the Social Marginal Benefit (MC = MB). The certain hue and cry from private users for

additional AN/PSC-3s (e.g.,as an expression of excess demand for access) would be controlled by one of several demand management techniques, depending upon the reasons for excess demand and the effect desired.

Economic theory, however, fails to translate that simply into a decision making model. The Solomon-like decision maker with the power to implement the decision may be an unrealistic assumption. Instead, applied economics provides a logical framework for analyzing problems and problem solving. Clearly, in most decisions, a precise mathematical formula describing the demand function or supply function will not exist. Applied economics, therefore, attempts to identify all significant costs, benefits, and rational assumptions relating to the decision; then, using the theoretical decision framework, deduce an approximate optimal level. Some trial and error is expected for fine-tuning the assumptions in the economic model.

C. HOW THE "SYSTEM" WORKS

In practice, there are no omniscient and omnipotent overseers. Bureaucracies tend to have members with varied levels of expertise and multiple layers of diffuse and incomplete information. Goals, motivations, and objectives differ between layers.

Within a MAGTF, motivation, goals, and objectives center around accomplishing an assigned mission with the fewest numbers of casualties (as well as other social and political constraints). Demand, therefore, is not economically constrained. A MAGTF would clearly want the best command and control system available to accomplish its mission. Conversely, from the social viewpoint, giving 100-percent of all command and control assets (or even all the cream of the crop) to a single MAGTF would reduce the overall effectiveness of other MAGTFs and sister forces. Under certain circumstances, additional assets may be shifted to a given MAGTF, however, decision makers try to optimize the overall force structure using constrained fiscal assets.

The acquisition system uses at least two mechanisms to address the divergent goals and incentives within the decision making hierarchy. First, the system tries to

smooth the differences in experience and information between levels by moving operationally experienced personnel into acquisition related billets and acquisition experienced personnel back into operational billets. A well informed decision making body is expected to then evolve. However, the system fails to mirror economic theory because it is fundamentally unable to align private user motivations, goals, and considerations with the social perspective.

Second, the system uses a "sequential weeding" process to weed out and cultivate private user demands with regards to broader social factors and considerations. Figure 4 , page 26, helps illustrates this process. Assume that a MAGTF as a private user submits a MILSATCOM URDB Requirement Request Form. The chain of command reviews the request, modifies it based on broader social factors (e.g. adding private user unrecognized costs, consolidating the request with other similar requests, etc.) and forwards the request further up the chain. If the request satisfies the broader decision criteria at each successive level, the requirement is added to the URDB where JCS and PPBS priorities for acquisition are influenced.

In terms of Figure 3, page 13, private users will submit requests up to the point where PMC = D. Thus the requests submitted by the private users reflects the private optimal allocation of resources. The user forces the system to eliminate those requests where SMC > D. The system therefore requires information regarding demand and the costs not incurred by the private users. For the sequential weeding process to work successfully, this information must be provided by the decision-making hierarchy.

The decision-making process and documentation requirements are designed to provide the system with demand and cost information. For example, information provided in the MILSATCOM URDB Requirement Request Form (Appendix A) could be considered as a beginning point for defining the private user's (e.g., MAGTF) demand for access. In this case, demand for access to a specific UHF satcom network implicitly contains a demand for access to UHF satcom ground terminals. Without the terminals, the network is dysfunctional and meaningless.

The Mission Element Need Statement (MENS), as shown in Appendix B, begins to define qualitatively additional aspects of private user demand as well as the social user demand function. MENS provides an assessment of need (Appendix B, section D) which discusses the benefits of the system with regards to the need being fulfilled. Similarly, social supply functions are qualitatively described in economic terms. For example, MENS takes an initial stab at identifying social determinants of supply. The types of constraints listed in Appendix B, section B, give some clue to costs associated with the project. As seen previously in Table 2, page 10, the bulk of supply costs are recognized only at the social level. In both the Joint Strategic Planning Document (which eventually translates into taskings, needs, and requirements) and the MILSATCOM URDB Requirement Request Form, private users are not constrained by economic fiscal considerations. In some cases, accounting fiscal considerations are inappropriately considered as a qualitative determinant of supply (e.g., sunk costs in Appendix A, paragraph 18 comments: "$50,000,000 has been spent on UHF terminals.") Accounting costs are not necessarily economic costs and therefore do not figure into the supply function. Economic costs refer to the marginal costs associated with acquiring more UHF satcom ground terminals than presently held. Later in the PPBS cycle, other cost-benefit analyses may be performed to more clearly identify aspects (determinants) of the social supply function.

Throughout the PPBS process and the subsequent budget approval process, tradeoffs occur which force an "optimal" solution to occur. Based on relative priority of the acquisition and approved funding levels, program buy levels are cut, modified, or otherwise affected (and in some cases, Congress may unilaterally increase buy levels). Additionally, buys may be spread over several funding periods and budgets. The resulting end quantity of units bought can be equated to an optimal solution when viewed from the big picture level (although private users may still argue that their individual demands have not been met and national security thus suffers).

D. CAN WE EXPECT THE "SYSTEM" TO WORK?

Critics and proponents alike point out the complexity of the acquisition process. Critics argue that the system fails to bridge the gap between the "user" and the "procurer". Proponents point out that the lack of user understanding of the system leads to unrealistic expectations of performance. Assuming the same perfectly informed body of decision makers that economic theory describes and goal congruence throughout the acquisition process, clearly, the system should work well. In fact, the system is suboptimal.

Information is asymmetrically distributed throughout the organization. Decision makers at different layers know what they know, but have only limited ways of identifying what information is held at other layers. Private users may distort information, either purposefully to enhance their position or because they lack information upon which to base their decision/requests. Decision makers at higher levels have no independent source of information to evaluate subordinate decisions or requests. They must rely heavily on private user provided information. Varying degrees of expertise at each level can cause misinterpretations or oversights.

As discussed earlier, goals, motivations, and objectives differ between decision making levels and these factors can further bias available information. The private user has few incentives to provide complete, unbiased information. In fact, the private user recognizes that good marketing techniques are required to receive favorable consideration for a private user demand function requirement. Asymmetrical information and divergent incentives can seriously compromise the sequential weeding process embodied in acquisition practices.

There is empirical evidence that these flaws lead to system break-downs. For example, the acquisition process for UHF satcom ground terminals was placed on hold when it became apparent that the sequential weeding process was failing.

1. JCS Moratorium on Ground Terminal Acquisition

On 26 January 1982, the Undersecretary of Defense for Research and Evaluation (USDRE) sent a memorandum to all service secretaries and the Joint Chiefs of Staff concerning the "Uncontrolled Proliferation of Non-Processed UHF

Satcom Terminals." [Ref. 15] This memorandum addressed USDRE's concern that procurements were "out of control." [Ref. 15] Two issues were raised:

- Technical interoperability and joint interoperability of ground terminals and satellite networks were at risk due to the variety of ground terminals being procured from military and commercial sources; and
- It hypothesized that limiting the number of terminals would translate to limiting the increasing demand for new satellite networks. [Ref. 15]

Acting on this memorandum, JCS imposed a moratorium on ground terminal procurement. This moratorium was lifted several years later when a new UHF satcom ground terminal procurement policy was implaced. In general, the new policy appointed the Army as the executive agent for purchasing portable ground terminals, the Navy for shipboard terminals, and the Air Force for airborne terminals. Justification was required showing that requested procurement quantities directly supported a validated requirement and that the terminal met standardized technical criteria.

2. The Moratorium Fallout

The moratorium provided emergency damage control to the system, however, it may have failed to correct the problem. While the moratorium stimulated concern for technical and joint interoperability criteria for ground terminal systems, the second issue was not clearly addressed in the fix.

The moratorium created several new layers of information for decision makers to consider. Given a fixed number of satellite pathways, users (social and private) are still unable to determine the optimal number of ground terminals to acquire. Employment objectives are still diverse. Two schools of employment objectives emerged:

- Many low volume users share the same pathway (e.g. Fleet Satellite Broadcast, CUDIXS/NAVMACS, a fleet satellite secure voice net, etc.) This results in fewer pathways required; and
- Point to point, limited use, or specialized networks require more pathways which would serve fewer users. [Ref. 15]

If the sequential weeding process resulted in the first school of thought becoming the predominant network-type approved, then the moratorium incorrectly correlated terminals and pathways. Pathways would have multiple users, therefore,

numbers of terminals would not be a good indicator of pathways required. If the predominance of networks had a low user to pathway ratios (e.g. 3 users to 1 pathway or point to point), then terminals would better predict pathway access requirements. More terminals would result in more pathway demand.

E. FIXING THE SYSTEM

Recognizing that the system fails to achieve the goal of optimizing command and control given fiscal constraints, and more specifically fails to optimize the numbers of UHF satcom ground terminals required, four courses of action exist:

- Do nothing (and pray for the best);
- Continue to monitor the diffusion of information, expertise, goals, objectives, etc. through additional administrative controls (an exogenous approach);
- Change the system so that private user demand and supply functions more closely resemble social demand and supply functions indicating that goal congruence and information is shared at all levels (an endogenous approach); and
- Some combination of the above.

1. Doing Nothing -- The Unanswer!

Doing nothing is not part of the Marine Corps culture. "Lead, follow, or get the hell out of the way" more accurately describes Marine philosophy. Clearly, if the system suffers, the Marine Corps (and DOD) must tackle the problem head on.

2. Exogenous Versus Endogenous.

Both the exogenous and the endogenous approach borrow from the principal-agent (agency) theory developed in accounting, finance, economics, marketing, political science, sociology, and organizational behavior literature. "[The principal-agent problem arises] when (a) the desires or goals of the principal and agent conflict and (b) it is difficult or expensive for the principal to verify what the agent is actually doing." [Ref. 16, pp. 57-58].

In this case, the principal would be the Marine Corps as a social user. Agents would include private users. As discussed earlier, there are conflicts in goals between private and social users. Additionally, the information and experience

diffusion makes it costly and nearly impossible for the social user (principal) to monitor the private user (agent) performance. Private user performance would include defining private demand and supply functions. "As a result, agents can engage in strategic behavior to further their objectives at the principal's expense." [Ref, 17, p.1]

The current system employs an exogenous approach to force agents to perform in the best interest of the principal. As noted, the checks and balances (documentation, reports, decision memorandums, etc.) of the sequential weeding process insufficiently provide the monitoring capability required for evaluating agent performance. A significant problem in this approach is that higher levels in the chain of command have limited access to reliable and independent information. Most of the information upon which decisions are based comes from subordinates. Thus, the reliance on subordinate furnished information or data creates difficulties in monitoring subordinates. Due to this dependency, the exogenous approach has limited effectiveness as an incentive for causing the agent to act in the best interest of the principal. Additional red-tape and bureaucracy only adds costs and delays. Negative incentives encourage private users to manipulate the system to avoid the bureaucratic jungle and achieve their goals.

The endogenous approach would involve changing the current system to include some type of incentive for private users to align their goals and demands more closely with the social supply and demand functions. Demand management techniques support this approach. As discussed earlier in Chapter II, demand management techniques force the private user to recognize more of the costs associated with the social supply curve. Pricing schemes which raise the cost borne by the private user result in a lower quantity of UHF ground terminals demanded. Ultimately, the goal is to cause the Private Marginal Cost Curve to equal the Social Marginal Cost Curve (PMC = SMC). When this occurs, the agent's decision criteria are the same as the principal's and therefore the agent responds in a manner favorable to the principal.

3. Trade-offs and Combinations.

The concept of private users paying for acquisition immediately sounds foreign and untenable: *The system doesn't work that way!* Certainly the acquisition culture has not supported such a concept until recently. Empirical review suggests, however, that acquisition through CINC-initiative funds are essentially private user economic decisions. These funds are allocated by designated commanders-in-chief (CINCs) for acquiring theater specific equipment to include certain communication assets. If the CINC feels strongly that the standard acquisition system has not provided sufficient assets based on CINC priorities, the CINC has a limited budget to satisfy this demand. In this manner, the CINC bears more of the social costs of acquisition than the private user supply function would indicate.

Some control system is necessary, of course, to ensure that technical and joint interoperability is maintained. A possible contributing factor to the JCS moratorium on ground terminal acquisition mentioned earlier was the poorly coordinated CINC-initiative funding for UHF satcom ground terminals which resulted in interservice communication shortfalls.

The current system provides a framework for identifying social (military wide) needs and requirements. Within this framework, approximate figures for quantities of UHF satcom ground terminals can be derived. Using an appropriate pricing scheme, the actual quantities could be fine tuned. High value users, such as a Marine Expeditionary Force, would willingly pay for the level of ground terminals they determined was required. Lower value users, perhaps a Marine Expeditionary Unit, would have a lower quantity demanded and would be satisfied with fewer, less costly to the private user, ground terminals.

The actual mechanics of private user and social user budgeting for acquisition is beyond the scope of this thesis.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

Throughout this thesis, economic theories and concepts have been used to discuss allocating scarce fiscal resources for acquiring UHF satellite communication ground terminals. The intent of the thesis was to provide an overview of current acquisition practices and suggest places where applied economics could explicitly aid in better decision making.

B. CONCLUSIONS

- Current acquisition practices appear inefficient and suboptimal. The exogenous approach can create disincentives to optimal decision making.
- Applied economics, while requiring a significant change in the Marine Corps acquisition culture, can improve the incentives for private users to make appropriate acquisition decisions and requests. Using the endogenous approach, the goals of the private user (e.g., MAGTF) become more congruent with the goals of the social user (e.g., Marine Corps), thereby creating an environment for improved decentralized decision making.

C. RECOMMENDATIONS FOR FURTHER RESEARCH

Several places throughout the thesis, questions have been generated concerning the mechanics of implementing economic concepts or preparing the acquisition culture for planned change. Additionally, due to the artificial focus of the thesis, related acquisitions have been ignored. Similarly, this thesis has chosen not to address questions about demand for access to satellite pathways and pathway usage optimization. Any one of these gaps require additional consideration sufficient to warrant a separate thesis.

Specific areas for follow-on research include:

- An economic evaluation of demand for access to ground terminal management techniques;

-- The mechanics of implementing pricing and priority schemes;

-- A comparison of theoretical outcomes to experimentally based outcomes;

- An economic evaluation of demand for access to satellite pathways and associated demand management techniques; and
- An economic evaluation of demand for use of satellite communication systems and associated demand management techniques[5].

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[5]LCDR. K.A. Dimaggio's thesis, "Pricing as a Demand Management Tool for Record Communications" addresses some of these issues.

APPENDIX A (MILSATCOM URDB REQUIREMENT REQUEST FORM)

FOR MSO USE ONLY
SOURCE DOCUMENT ID
____

MILSATCOM URDB REQUIREMENT REQUEST FORM

1 DATE ___/___/_____
MM DD YY

2 TYPE OF REQUEST (CHECK ONE)
___A - NEW REQUIREMENT (COMPLETE ENTIRE FORM EXCEPT ITEM 4)
___B - CHANGES TO EXISTING REQUIREMENT (COMPLETE ITEMS 1 THRU 5 AND ONLY THOSE ITEMS TO BE CHANGED)
___D - DELETION OF EXISTING REQUIREMENT (COMPLETE ITEMS 1 THRU 5 ONLY)

3 SUBMITTING COMMAND, AGENCY OR ACTIVITY ________ SUB-COMMAND (OPTIONAL) ________

4 CONTROL NUMBER (MANDATORY FOR CHANGES AND DELETIONS) ________

5 POINT OF CONTACT
NAME ________________ PHONE (____)____-________
OFFICE CODE ________________

6 LOCATION INFORMATION (REFERENCE APPENDICES IN URDB USERS MANUAL OR DCAC 310-65-1 FOR CODES)

ENDPOINT	FROM	TO
NAME		
GEOLOC CODE		
STATE/COUNTRY CODE		
AREA		
LATITUDE (IF STATIONARY)		
LONGITUDE (IF STATIONARY)		
OPERATING PLATFORM (PROVIDE THE REQUESTED INFORMATION OR IF UNKNOWN JUST CHECK THE APPROPRIATE BLOCK)	TERMINAL ANTENNA SIZE	TERMINAL ANTENNA SIZE
A - AIRCRAFT		
B - SHIP		
F - FIXED OR SEMI-FIXED		
P - MAN PORTABLE		
S - SUBMARINE		
T - TRANSPORTABLE		
V - VEHICLE (MOBILE)		
X - MULTIPLE TYPES (GROUND AIR SHIP)		

7 TIME FRAME REQUIRED ______ ______
QUARTER YEAR

8 TYPE OF SERVICE (CHECK ONE)
___D - DATA (NOT MULTIPLEXED)
___F - FACSIMILE (NOT MULTIPLEXED)
___I - IMAGERY (NOT MULTIPLEXED)
___M - MULTICHANNEL TRUNKING MULTIPLEXED AT THE SWITCHES OR SUBSCRIBER TERMINALS FOR TRANSMISSION IN ONE SERIAL BIT STREAM
___R - REMOTE CONTROL KEYING LINE
___T - TELETYPE RECORD TRAFFIC (NOT MULTIPLEXED)
___V - VOICE OR VOICE EQUIVALENT (ANALOG OR DIGITAL)
___Y - ORDER WIRE/SYSTEM CONTROL CIRCUIT/TECHNICAL CONTROL
___B - BURST NARRATIVE

9 DIGITAL DATA RATE OR ANALOG BANDWIDTH (INCLUDE UNITS OF MEASUREMENT)
________ ________ (K= KILOBITS, B= BITS/BAUD, M= MEGABITS)
PREFERRED MINIMUM ACCEPTABLE (UNDER NON-STRESSED CONDITIONS)

10 TYPE OF OPERATION (CHECK ONE) (CORRESPONDS TO DCAC 310-65-1)
___F - FULL DUPLEX (DIRECTIONS 1 AND 2 MIRROR IMAGE)
___G - FULL DUPLEX (DIRECTIONS 1 AND 2 NON-MIRROR IMAGE)
___R - HALF DUPLEX (TRANSMIT ONE DIRECTION ONLY)
___H - HALF DUPLEX (TRANSMIT BOTH DIRECTIONS - MIRROR IMAGE)
___J - HALF DUPLEX (TRANSMIT BOTH DIRECTIONS - NON-MIRROR IMAGE)
___M - MULTIPOINT FULL DUPLEX (CONFERENCING)
___P - MULTIPOINT HALF DUPLEX (CONFERENCING)
___N - MULTIPOINT HALF DUPLEX (BROADCAST)

11 PERCENT OF USAGE (FOR DETERMINING TIME SHARING POSSIBILITIES) ESTIMATE THE PERCENTAGE OF ACTUAL CIRCUIT USE ANTICIPATED DURING A 24-HOUR PERIOD ________%

12 QUALITY OF SERVICE (CHECK ONE)
___D DCS VOICE QUALITY
___M MINIMUM ESSENTIAL EMERGENCY COMMUNICATION NET (MEECN) ACCURACY REQUIRED OR FOR EAM DISSEMINATION
___T - TACTICAL VOICE QUALITY
___S - SPEECH-PLUS DUPLEX
___3 - BIT ERROR RATE (BER) OF 10-3
___4 - BER OF 10-4
___5 - BER OF 10-5
___6 - BER OF 10-6
___7 - BER OF 10-7
___8 - BER OF 10-8
___9 - BER OF 10-9

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13 HOW IS THE REQUIREMENT PRESENTLY SATISFIED? (CHECK ONE)

___A · AFSAT
___B · AIRBORNE SYSTEM
___C · LEASAT
___D · DSCS II/DSCS III
___F · FLTSATCOM
___G · GAPFILLER
___H · LES 8/9
___I · ATS
___J · SDS
___K · LEASE COMMERCIAL CIRCUIT (INCLUDING DOMSAT INTELSAT ETC)
___N · NATO
___Q · NOT BEING SATISFIED
___T · TERRESTIAL SYSTEM (GOVERNMENT OWNED)
___X · SPECIAL SATELLITE

14 IF CIRCUIT IS OPERATIONAL AND BEING SATISFIED BY DSCS OR DCS, PLEASE GIVE FOLLOWING

CCSD NUMBER ________

15 IS THE SERVICE REQUESTED PROVIDING (CHECK ONE)
___P · PRIMARY OR ___B · BACKUP COMMUNICATIONS CAPABILITY?

16 IS THE APPLICATION ___T · TACTICAL OR ___S · STRATEGIC?

17 MISSION TYPE (CHECK ONE)

___OW · ORDER WIRE
___PR · PRESIDENTIAL
___NC · NCA
___CI · CRITICAL INTELLIGENCE
___AW · ATTACK WARNING
___AS · ANTI-SUBMARINE OPERATIONS
___DP · DIPLOMATIC
___SC · STRATEGIC COMMAND & CONTROL
___ME · MEECN
___SS · SENSOR SYSTEMS
___CD · CIVIL DEFENSE
___IT · INTERSWITCH TRUNKING
___AO · AIR OPERATIONS
___WE · WEATHER
___TC · TACTICAL COMMAND & CONTROL
___LO · LOGISTICS

18 PLANNED SATISFACTION (ONLY TO BE COMPLETED IF YOU HAVE ADEQUATE JUSTIFICATION FOR EXAMPLE, $50 000 000 HAS BEEN SPENT ON UHF TERMINALS) (CHECK ONE)

___D2 · DSCS II
___D3 · DSCS III
___FL · FLTSAT
___LS · LEASAT
___KX · EXPERIMENTAL SAT
___XX · CLASSIFIED SAT
___N2 · NATO II
___N3 · NATO III
___DS · DOMSAT
___AF · AFSAT/FLTSAT
___AS · AFSAT/SDS
___AO · AFSAT/OTHER
___MS · MILSTAR
___CM · COMMERCIAL
___FU · FUTURE DESIGN
___GS · FOLLOW-ON SHF UPLINK AND DOWNLINK
___SU · FOLLOW-ON SHF UPLINK AND UHF DOWNLINK
___SX · FOLLOW-ON SHF UPLINK TO SHF/UHF DOWNLINK
___UU · FOLLOW-ON UHF UPLINK AND DOWNLINK
___US · FOLLOW-ON UHF UPLINK AND SHF DOWNLINK
___UX · FOLLOW-ON UHF UPLINK AND UHF/SHF DOWNLINK

JUSTIFICATION FOR YOUR PLANNED SATISFACTION ________

19 WHAT WOULD THE IMPACT BE IF THIS SERVICE WERE NOT PROVIDED BY MILSATCOM? ________

20 NETWORK NAME ________ ACRONYM (8 CHARACTERS) ________

21 CRITERIA FOR INCLUSION (CHECK ONE)

___A · A MILSATCOM SYSTEM IS THE ONLY POSSIBLE TRANSMISSION MEDIUM WHICH CAN FULFILL THE QUANTITATIVE CHARACTERISTICS OF THE REQUIREMENT
___B · OPERATIONAL CONSIDERATIONS SUCH AS RELIABILITY SURVIVABILITY SECURITY AND FLEXIBILITY REQUIRE USE OF A MILSATCOM SYSTEM BASED ON APPROVED OPERATIONAL CONCEPT, SYSTEMS UTILIZATION PLAN OR OTHER PROGRAM PLANS
___C · ECONOMIC ANALYSES WERE USED TO SELECT BETWEEN USE OF A MILSATCOM SYSTEM AND OTHER TRANSMISSION MEDIUM (COST COMPARISONS MUST BE INCLUDED WITH THIS FORM IF THIS IS THE ONLY CRITERIA FOR INCLUSION)
___D · COMBINATION OF A AND B ABOVE
___E · COMBINATION OF A, B AND C ABOVE
___F · COMBINATION OF B AND C ABOVE

22 SUMMARIZE THE REQUIREMENT NETWORK IN GENERAL TERMS OF PURPOSE AND USE (PROVIDE CONCEPT OF OPERATIONS OPERATING CONDITIONS WHOM IT SUPPORTS HIERARCHY INTERCONNECTS NATURE OF TRAFFIC ETC)

23 SERVICE AVAILABILITY (CHECK ONE) (CORRESPONDS TO DCAC 310-65-1)

___ A - FULL PERIOD (PERTAINS TO TIME AVAILABLE IN CONSTANT TRANSMISSION)
___ B - TIME SHARED (MAY BE USED ALTERNATIVELY BY ALL TERMINALS OR ON A TIME-SHARED BASIS PART OR ALL OF THE CIRCUITS SEGMENTS ARE SHARED WITH ONE OR MORE OTHER CIRCUITS)
___ C - SIX HOURS OR LESS
___ D - MILITARY SATELLITE DEMAND ASSIGNMENT - AVAILABLE AS SCHEDULED BY THE SATELLITE COMMUNICATIONS CONTROL FACILITY
___ E - BETWEEN 6 AND 12 HOURS
___ F - BETWEEN 12 AND 18 HOURS (MORE THAN 18 HOURS WILL BE REPORTED AS FULL PERIOD)
___ G - ON CALL (ACTIVATED ON REQUEST OF USER) THESE ARE CIRCUITS OR SEGMENTS OF CIRCUITS WHICH ARE CALLED UP THROUGH THE DCS TECHNICAL CONTROL OR ACTIVATED DIRECTLY BY THE USED THROUGH A CONTROL LEAD
___ H - PROGRAMMED REROUTE - ROUTING ALLOCATED TO AN EXISTING CIRCUIT VIA DIFFERENT TRANSMISSION PATHS ON AT LEAST ONE SEGMENT OF THE ROUTING BUT CONNECTING THE SAME TERMINAL POINTS THIS ROUTE IS AVAILABLE FULL TIME TO THE USER BUT IS USED ONLY WHEN ACTIVATED
___ J - SECOND ALLOCATED PATH - A SECOND ALLOCATED PATH IS USED TO PROVIDE SIMULTANEOUS SERVICE FOR THE CORRESPONDING FULL PERIOD PATH THIS IS A SEPARATE, DISTINCT COMPLETE PATH BETWEEN SERVING TECHNICAL CONTROLS/USERS, CARRYING THE SAME TRAFFIC AS THE A ROUTE, BUT WITH NO COMMON SEGMENTS BETWEEN SERVING TECHNICAL CONTROLS
___ K - FREQUENCY SHARED (MAY BE EITHER FULL OR PART TIME)
___ L - CONTINGENCY REQUIREMENT, ACTIVATION IN ACCORDANCE WITH APPROPRIATE OPLAN (CSIF CHARGES NOT APPLICABLE FOR AUTODIN AND AUTOVON)
___ P - PROGRAMMED PREEMPT (FIRST PRIORITY LEVEL) - CARRIES PREEMPTION EQUIPMENT ON-LINE TO AUTOMATICALLY PREEMPT THE ASSOCIATED CIRCUIT
___ Q - ON CALL CARETAKER STATUS USED FOR ON CALL CARETAKER STATUS PACKAGE SYSTEM CROSS REFERENCE CIRCUITS ONLY ACTIVATED ONLY AS DIRECTED BY PROPER AUTHORITY
___ R - RESERVED COMMERCIAL FACILITY (NOT AVAILABLE UNTIL CSA ISSUED)
___ S - PROGRAMMED PREEMPT (SECOND PRIORITY LEVEL) - AUTOMATICALLY PREEMPTS
___ T - PROGRAMMED PREEMPT (THIRD PRIORITY LEVEL) - AUTOMATICALLY PREEMPTS

24 PROVIDE A GENERALIZED STATEMENT OF THE GEOGRAPHIC RANGE THAT THE NET WOULD COVER ___

25 THE DUTY FACTOR DESCRIBES THE TIME THE CIRCUIT IS ACTUALLY IN USE (PASSING TRAFFIC) FILL IN THE NUMBER OF MINUTES OF ACTUAL CIRCUIT OPERATION FOR THE AVERAGE HOUR AND FOR THE BUSY (PEAK) HOUR

	NORMAL OPERATION	WARTIME OPERATIONS
BUSY HOUR		
AVERAGE HOUR		

26 IS JAM RESISTANCE A REQUIREMENT? ___ Y - YES ___ N - NO
IF SO, WHAT IS THE MINIMUM DATA RATE ACCEPTABLE UNDER STRESSED CONDITIONS? ___

27 MAXIMUM NUMBER OF CIRCUITS FOR THIS REQUIREMENT (2 DIGITS) ___ (IF MORE THAN ONE, CIRCUITS MUST BE IDENTICAL OTHERWISE MUST BE PRESENTED ON SEPARATE REQUIREMENT FORMS)

28 ALTERNATIVES AVAILABLE (CHECK ONE)

___ A - NON-ELECTRICAL MEANS ONLY (COURIER)
___ B - BEYOND THE HORIZON SINGLE CHANNEL RADIO ONLY
___ C - LINE-OF-SIGHT (LOS) SINGLE CHANNEL RADIO ONLY
___ D - TERRESTRIAL MULTI CHANNEL (E G TELEPHONE AND CABLE RADIO MICROWAVE TROPOSPHERIC SCATTER)
___ E - OTHER SATELLITE AVAILABLE (MORE THAN ONE SATCOM MEANS)
___ F - MULTIPLE MEANS AVAILABLE (A VARIETY OF COMMUNICATIONS MEANS OF HIGH AVAILABILITY RELIABILITY AVAILABLE TO BOTH COMMERCIAL AND MILITARY SUCH AS IN CONUS)
___ G - NO OTHER RESONABLE MEANS AVAILABLE

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29 PRIORITY (CHECK ONE)

JOINT MANAGED SYSTEMS

__ J1 - COMMUNICATIONS REQUIREMENT OF THE PRESIDENT AND THE NCA
__ J2 - COMMUNICATIONS REQUIREMENT OF THE JCS
__ J3 - UNIFIED AND SPECIAL COMMUNICATIONS REQUIREMENTS TO INCLUDE THOSE SERVICES COMMUNICATIONS REQUIREMENTS OF GMF NAVAL FORCES AND AIR FORCES ORGANIC TO COMPONENT COMMANDS AND JOINT TASK FORCES OF THE UNIFIED AND SPECIFIED COMMANDS
__ J4 - DCS REQUIREMENTS AND SERVICE COMMUNICATIONS REQUIREMENTS OF THE MILDEPS FOR GMF, NAVAL FORCES AND AIR FORCES NOT ORGANIC TO COMPONENT COMMANDS OF THE UNIFIED AND SPECIFIED COMMANDS
__ J5 - NON DOD NATIONAL REQUIREMENTS
__ J6 - NATO AND ALLIED GOVERNMENT REQUIREMENTS AS SPECIFIED BY INTERNATIONAL AGREEMENTS

SERVICE MANAGED SYSTEMS

__ S1 - COMMUNICATIONS REQUIREMENT OF THE PRESIDENT AND THE NCA
__ S2 - COMMUNICATIONS REQUIREMENT OF THE JCS
__ S3 - SERVICE COMMUNICATIONS FOR MINIMUM ESSENTIAL NEEDS IN SUPPORT OF OPERATING FORCES
__ S4 - SERVICE COMMUNICATIONS REQUIREMENTS ESSENTIAL TO OPERATING FORCES NOT INCLUDED IN S3
__ S5 - OTHER APPROVED COMMUNICATIONS REQUIREMENTS

30 IS SURVIVABILITY REQUIRED FOR THIS CIRCUIT (E G, IN A NUCLEAR ENVIRONMENT)? __Y - YES __N - NO

31 EXPLAIN ANY SURVIVABILITY REQUIREMENTS AND GIVE NECESSARY DURATION OF SURVIVABILITY ____________

32 DESCRIBE ANY INTERFACES WITH OTHER COMMUNICATIONS NETWORKS OR SYSTEMS LIST OTHER SUBSCRIBERS OF THIS NET IF KNOWN (PROVIDE FACILITY NUMBER AND TYPE OF TERMINALS, CONFIGURATION, EMPLOYMENT AND OTHER PERTINENT DATA) ____________

33 INDICATE THE USER COMMUNITY THAT IDENTIFIES THE PRIMARY PURPOSE FOR THIS SATELLITE COMMUNICATIONS REQUIREMENT

COMMAND/SUPPORT FORCES
__ I - WIDEBAND (DDP SCF, INTELLIGENCE) __ D - DCS (AUTOVON AUTODIN WWMCCS ADP WHCA, DEDICATED CIRCUITS) __ E - DIPLOMATIC TELECOMMUNICATIONS SYSTEM __ F - FLEET OPERATIONS (HIGH CAPACITY) __ G - TACTICAL MULTICHANNEL (GMF) __ W - TACTICAL WARNING AND ATTACK ASSESSMENT
NUCLEAR CAPABLE FORCES
__ B - THEATER NUCLEAR FORCES __ C - WWMCCS/SIOP CINCNET __ J - SIOP (EAM) __ S - SIOP FORCE NET (BOMBERS TANKERS ICBM, SLBM, ALCM CARRIER) __ K - SSBN REPORT BACK
CONVENTIONAL (NON-NUCLEAR) FORCES
__ L - TACTICAL SINGLE CHANNEL __ M - MANPACK __ P - FLEET OPERATIONS (LOW CAPACITY) __ A - AIR OPERATIONS __ Q - AIRBORNE RECONNAISANCE RELAY

NETWORK DIAGRAM

34 THIS DIAGRAM SHOULD COMPLEMENT PRECEDING NARRATIVE INPUT SHOW CONNECTIVITY WITHIN THE NET INTERFACES TO OTHER NETWORKS NETWORK CONTROL STATION (NCS) AND MINIMUM ESSENTIAL EMERGENCY COMMUNICATIONS NETWORK REQUIREMENTS INDICATE CLASSIFICATION IF REQUIRED

35 REMARKS PLEASE PROVIDE ANY ADDITIONAL COMMENTS OR INFORMATION YOU FEEL WOULD BE HELPFUL (ONLY 79 CHARACTERS TO BE STORED IN DATA BASE) ______

THIS SECTION TO BE COMPLETED BY SYSTEM ARCHITECT

36 PLANNED SATISFACTION (CHECK ONE)

- __ D2 · DSCS II
- __ D3 · DSCS III
- __ FL · FLTSAT
- __ LS · LEASAT
- __ EX · EXPERIMENTAL SAT
- __ XX · CLASSIFIED SAT
- __ N2 · NATO II
- __ N3 · NATO III
- __ DS · DOMSAT
- __ AF · AFSAT FLTSAT
- __ AS · AFSAT SDS
- __ AO · AFSAT OTHER
- __ MS · MILSTAR
- __ CM · COMMERCIAL
- __ FU · FUTURE DESIGN
- __ SS · FOLLOW ON SHF UPLINK AND DOWNLINK
- __ SU · FOLLOW ON SHF UPLINK AND UHF DOWNLINK
- __ SX · FOLLOW ON SHF UPLINK TO SHF/UHF DOWNLINK
- __ UU · FOLLOW ON UHF UPLINK AND DOWNLINK
- __ US · FOLLOW ON UHF UPLINK AND SHF DOWNLINK
- __ UX · FOLLOW ON UHF UPLINK AND UHF/SHF DOWNLINK

37 PRIORITY (CHECK ONE)

JOINT-MANAGED SYSTEMS

- __ J1 · COMMUNICATIONS REQUIREMENT OF THE PRESIDENT AND THE NCA
- __ J2 · COMMUNICATIONS REQUIREMENT OF THE JCS
- __ J3 · UNIFIED AND SPECIAL COMMUNICATIONS REQUIREMENTS TO INCLUDE THOSE SERVICES COMMUNICATIONS REQUIREMENTS OF GMF, NAVAL FORCES, AND AIR FORCES ORGANIC TO COMPONENT COMMANDS AND JOINT TASK FORCES OF THE UNIFIED AND SPECIFIED COMMANDS
- __ J4 · DCS REQUIREMENTS AND SERVICE COMMUNICATIONS REQUIREMENTS OF THE MILDEPS FOR GMF, NAVAL FORCES, AND AIR FORCES NOT ORGANIC TO COMPONENT COMMANDS OF THE *UNIFIED AND SPECIFIED COMMANDS*
- __ J5 · NON-DOD NATIONAL REQUIREMENTS
- __ J6 · NATO AND ALLIED GOVERNMENT REQUIREMENTS AS SPECIFIED BY INTERNATIONAL AGREEMENTS

SERVICE-MANAGED SYSTEMS

- __ S1 · COMMUNICATIONS REQUIREMENT OF THE PRESIDENT AND THE NCA
- __ S2 · COMMUNICATIONS REQUIREMENT OF THE JCS
- __ S3 · SERVICE COMMUNICATIONS FOR MINIMUM ESSENTIAL NEEDS IN SUPPORT OF OPERATING FORCES
- __ S4 · SERVICE COMMUNICATIONS REQUIREMENTS ESSENTIAL TO OPERATING FORCES NOT INCLUDED IN S3
- __ S5 · OTHER APPROVED COMMUNICATIONS REQUIREMENTS

38 VALIDATION STATUS (CHECK ONE) DATE OF VALIDATION/CHANGE (MM) (DD) (YY)

- __ V · REQUIREMENT HAS BEEN VALIDATED BY THE JCS
- __ Q · REVIEWED BY THE JCS BUT NOT VALIDATED PENDING ADDITIONAL INFORMATION TO THE JCS
- __ N · NEW REQUIREMENT NOT REVIEWED OR VALIDATED BY THE JCS
- __ C · REQUIREMENT HAS BEEN CHANGED BY THE USER AFTER HAVING BEEN VALIDATED BY THE JCS WILL REQUIRE RE-VALIDATION
- __ D · REQUIREMENT REVIEWED BUT NOT VALIDATED (DISAPPROVED)
- __ 4 · REQUIREMENT REVIEWED BY JCS BUT NOT VALIDATED DUE TO INABILITY TO IMPLEMENT AT THIS TIME

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APPENDIX B

(FORMAT FOR THE MISSION ELEMENT NEED STATEMENT)

Prepare MENS in the following format. Do not exceed five pages, including annexes. Reference supporting documentation.

A. MISSION

1. Mission Areas. Identify the mission areas addressed in this MENS. A need can be common to more than one mission area. When this is the case, identify the multiple mission areas.

2. Mission Element Need. Briefly describe the nature of the need in terms of mission capabilities required and not the characteristics of a hardware or software system.

B. THREAT OR BASIS FOR NEED

Summarize the basis for the need in terms of an anticipated change in the projected threat, in terms of an exploitable technology, or in terms of non-threat-related factors; e.g., continuing requirements for new pilots. When the need is based on a threat change, assess the projected threat over the period of time for which a capability is required. Highlight projected enemy force level and composition trends, system capabilities, or technological developments that define the quantity or quality of the forecast threat. Include comments by the Defense Intelligence Agency (DIA), and provide specific references from which the threat description is derived. Quantify the threat in numbers and capability. If nuclear survivability and endurance are required mission capabilities, include an explicit statement of this fact. When the need is based on exploitation of developing technology, describe the benefits to mission performance.

C. EXISTING AND PLANNED CAPABILITIES TO ACCOMPLISH THIS MISSION

Briefly summarize the existing and planned DOD or allied capabilities to accomplish the mission. This must not be a narrow, one-service view when looking across a multiservice or an overlapping mission area, such as air defense. Reference existing documentation, such as force structure documents.

D. ASSESSMENT OF NEED

The most important part of the MENS is the evaluation of the ability of current and planned capabilities to cope with the projected threat. Base the evaluation on one or more of the following factors:

1. Deficiency in the existing capability, such as excessive manpower, logistic support requirements, ownership costs, inadequate system readiness, or mission performance.

2. Exploitable technological opportunity.

3. Force size or physical obsolescence of equipment.

4. Vulnerability of existing systems.

E. CONSTRAINTS

Identify key boundary conditions for satisfying the need, such as:

1. Timing of need.

2. Relative priority within the mission area.

3. The order of magnitude of resources the DOD component is willing to commit to satisfy the need identified. This resource estimate is for initial reconciliation of resources and needs. It is not to be considered as a program cost goal or threshold.

4. Logistics, safety, health, energy, environment, manpower, and training considerations.

5. Standardization of interoperability with NATO and among the DOD components.

6. Potentially critical interdependencies or interfaces with other systems, and technology or development programs.

F. RESOURCE AND SCHEDULE TO MEET MILESTONE I

Identify an approximate schedule and an estimate of resources to be programed along with the approach proposed for developing alternative concepts for presentation to the Secretary of Defense at Milestone I.

[Extracted from Ref. 18, Appendix D]

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